

REMARKS

This application is a divisional of U.S. Patent Application 09/471,520, which was a continuation in part of U.S. Patent Application 08/874,220, which is a divisional of U.S. Patent Application 08/548,083. Claims 13-26 were pending in paper 4, mailed by the Office on 8/6/01. Claims 13-26 were pending in paper 6, mailed by the Office on 2/5/02. Claims 13-26 were pending in an Amendment filed by Applicants on 3/28/02. The Examiner incorrectly listed Claims 13-28 as pending in paper 10, mailed 4/24/02. Applicants canceled Claims 25-26 and added new claim 27 in an amendment filed by Applicants on 7/24/02. Applicants correctly stated "Claims 13-24 and 27 are pending." See Applicants' response to paper 10. Applicants respectfully submit that the Examiner incorrectly stated Claims 13-24 and 27-29 were pending in paper 12, the Office Action immediately following submission of Applicants' response on 7/24/02. See Paper 12, mailed 10/7/02. In fact, Applicants respectfully submit that Claims 13-24 and new Claim 27 were pending. Applicants respectfully submit that Claims 13-24, 27 and new Claims 28-31 are currently pending for consideration by the Examiner.

Claims 13-24 and 27-29 were rejected under the doctrine of obviousness-type double patenting as being allegedly unpatentable over claims 1-9 of U.S. Patent No. 6,129,955, ('055) in view of Christie *et al.*

The Examiner rejected claims 13-19, 21-24 and 27-29 under 35 U.S.C. §112, first paragraph, as allegedly based on a disclosure which is not enabling.

The Examiner rejected claims 13-24 and 27-29 under 35 U.S.C. §112, first paragraph, allegedly because "the specification, while being enabling for a method wherein the composition comprises a cyanate ester, and organometallic photoinitiator and a dispersed phase of particulate

silica and, optionally, thermally conductive and electrically insulating filler (Alumina, etc.), does not reasonably provide enablement of a method wherein the composition comprises a cyanate ester, any known photoinitiator and any known 'dispersed filler'."

The Examiner rejected claims 18 and 20 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner rejected claims 13-22, 24 and 27-29 under 35 U.S.C. §103(a) as allegedly being unpatentable over Christie *et al.* (5,250,848) in view of Gaku *et al.* (4,554,346).

The Examiner rejected claims 13-16, 18-22 and 27-29 under 35 U.S.C. §103(a) as allegedly being unpatentable over Christie *et al.* (5,250,848) in view of McCormick *et al.* (5,744,557).

The Examiner rejected claim 23 under 35 U.S.C. §103(a) as being allegedly unpatentable over Christie *et al.* (5,250,848) in view of Gaku *et al.* or McCormick *et al.*, as applied to claim 13 above, and further in view of Papathomas *et al.* (5,194,930).

Applicants respectfully traverse the §112 and §103(a) rejections with the following arguments.

Obviousness-type Double Patenting

The Examiner alleges Claims 13-24 and 27-29 are rejected under the judicially created doctrine of obviousness-type double patenting as being allegedly unpatentable over Claims 1-9 of U.S. Patent No. 6,129,955 (US '955) in view of Christie *et al.* The Examiner alleges "Christie *et al.* is relied upon for teaching that cyanate esters and/or polycyepoxides are useful for providing a solder interconnection." See the Office Action page 2, second sentence in second paragraph of Response to Arguments. Applicants respectfully traverse the Examiner's obviousness-type double patenting rejection on grounds that the Examiner improperly confused double patenting rejections with 35 U.S.C. 102(e) prior art obviousness rejections under 103(a).

A double patenting rejection must rely on a comparison with the claims in an issued or to be issued patent, whereas an obviousness rejection based on the same patent under 35 U.S.C. 102(e)/103(a) relies on a comparison with what is disclosed (whether or not claimed) in the same issued or to be issued patent. See MPEP, 8th Ed. § 804(III).

Here, the Examiner improperly relied on subject matter allegedly taught, but not claimed, by Christie *et al.*

Even if it would have been proper for the Examiner to use the alleged teaching of Christie *et al.*, i.e., "that cyanate esters and/or polycyepoxides are useful for providing a solder interconnection," the Examiner has not made clear why one of ordinary skill in the art would conclude that the invention defined in Applicants' Claims 13-24 and 27-30 are an obvious variation of the invention described by claims 1-9 of US '955. See the Office Action page 2, second sentence in second paragraph of Response to Arguments. See also MPEP §804(II)(B)(1)

Any obviousness-type double patenting rejection should make clear:

(A) The differences between the inventions defined by the conflicting claims - a claim in the patent compared to a claim in the application; and

(B) The reasons why a person of ordinary skill in the art would conclude that the invention defined in the claim in issue is an obvious variation of the invention defined in a claim in the patent.

The Examiner states "Although the conflicting claims are not identical, they are not patentably distinct from each other because the comprising language of the claims of US '955 encompasses compositions including a cyanate ester, such as the cyanate esters disclosed in columns 11-12 of the patent." Even if the Examiner did not err by relying on subject matter not claimed in US '955, and by relying on the not claimed subject matter allegedly taught by Christie *et al.*, Applicants respectfully contend the claims in US '955 claiming a composition **comprising an epoxide** are not only not identical to Applicants' Claims 13-24 and 27-30, but that they do not become more similar even if, as the Examiner argues, it were obvious that the comprising language of the claims in US '955 encompasses compositions including an epoxy resin and cyanates.

Applicants respectfully contend that Claims 13-24 and 27 claim, in part, "[A] method for encapsulating a solder joint between an integrated circuit chip and a substrate, comprising the steps of: forming a composition that includes a photoinitiator, a filler, wherein the filler has a particle size of 31 microns or less if the filler is silica, and a resin precursor, wherein the resin precursor **consists essentially of** a cyanate ester monomer, a cyanate ester prepolymer, or a

mixture of the monomer and prepolymer;" (emphasis added). In contrast, claims 1-9 of US '955 claim "a composition comprising an epoxy resin" (emphasis added). Applicants respectfully contend the Examiner's obviousness-type double patenting rejection fails because none of Applicants' Claims 13-24 that exclude epoxy resin are obvious over the claims of US '955 that include an epoxy resin, even if Christie *et al.* teaches compositions comprising a cycloaliphatic polyepoxide and/or cyanate ester or prepolymer thereof are useful for providing a solder interconnection. Nothing in Christie *et al.* excludes an epoxy resin from the claims of US '955 that recite forming a composition comprising an epoxy resin. See '955, claims 1-9.

In light of the foregoing, Applicants respectfully contend that the Examiner's double patenting rejection of Claims 13-24 and 27-29 fails because MPEP § 804(III) restricts the Examiner to rely on claimed subject matter in the cited prior art to support the obviousness-type double patenting rejection, and the claimed subject matter in the cited prior art does not teach each and every feature of Applicants' Claims 13-24 and 27-30.

35 U.S.C. §112, first paragraph

The Examiner rejected claims 13-19, 21-24 and 27-29 under 35 U.S.C. §112, first paragraph, as based on a disclosure that is not enabling. The Examiner alleged "a dispersed phase of particulate silica having a particle size of 31 microns or less is critical or essential" See the Office Action, page 3. Applicants respectfully traverse the Examiner's assertion that "a dispersed phase of particulate silica having a particle size of 31 microns or less is **critical or essential**," because Applicants' specification and original claims disclose a composition containing **filler** without limitation as to particle size (emphasis added). See *Id.* Applicants respectfully submit the Examiner relied on the second sentence in the following excerpt of Applicants' disclosure:

The silica is preferably a fused or amorphous silica. The particle size of the **filler** should be 31 microns or less, and preferably from about 0.5 microns to about 31 microns, and most preferably from about 0.7 to about 20 microns. This is necessary so that the uncured material flows readily before polymerization, and so that the composition will flow under the integrated circuit chip housing 31, between the housing 31 and the substrate 11. In addition the **silica filler** should be substantially free of ionics and ionic impurities which might contribute to reliability problems. See the Specification, page 25, lines 4-10.

Applicants respectfully submit the word **filler** means silica, in the context of the paragraph *supra* because the topic sentence of the paragraph *supra* states "The **silica** is preferably a fused or amorphous **silica**." See *Id.* Arguably, the word **filler** in the next sentence refers to the word silica in the first sentence and therefore the word **filler** means silica in the context of the

paragraph *supra*. However, Applicants respectfully submit the Examiner ignored that the paragraph *supra* is about silica, and relied upon the next sentence out of context for support of the rejection of Claims 13-19, 21-24 and 27-29 under 35 U.S.C. §112, first paragraph, that the particle size of the filler in Claims 13-19, 21-24 and 27-29 should be 31 microns or less.

Applicants respectfully submit that the phrase "**In addition the silica filler**" in the last sentence of the paragraph *supra* adds support to Applicants' argument that the word filler means silica in the context of the paragraph *supra* (emphasis added). See *Id.* Applicants submit the prepositional phrase, "**In addition**" means "also" or "as well." See idioms for "in addition" under "addition" in <http://www.dictionary.com>. Here, the topic sentence and "also" or "as well" the last sentence of the paragraph *supra* is about silica, and the phrase "**In addition the silica filler**" supports Applicants' contention that the whole paragraph *supra* is about silica, including that the filler that should be 31 microns or less is silica.

Therefore, the second sentence that the Examiner relies upon that states "the particle size of the filler should be 31 microns or less is **critical or essential**," applies only to embodiments of the cyanate composition having silica. See the Office Action, page 3. Accordingly, Applicants have amended Claim 13 that states, *inter alia*, "A method for encapsulating a solder joint between an integrated circuit chip and a substrate, comprising the steps of: forming a composition that includes a photoinitiator, a filler, and a resin precursor, **wherein the filler has a particle size of 31 microns or less if the filler is silica,**" (emphasis added).

The Examiner rejected Claims 13-24 and 27-29 under 35 U.S.C. §112, first paragraph, allegedly because the specification, while being enabling for a method wherein the composition comprises a cyanate ester, and organometallic photoinitiator and a dispersed phase of particulate

silica and, optionally, thermally conductive and electrically insulating filler (Alumina, etc.), does not reasonably provide enablement of a method wherein the composition comprises a cyanate ester, any known "photoinitiator" and any known "dispersed filler." Applicants respectfully traverse the Examiner's rejection under 35 U.S.C. § 112, first paragraph, because the propriety of the rejection depends on a two stage inquiry: 1) the scope of the term photoinitiators is within the scope of the enablement; and 2) one skilled in the art is enabled to make and use the entire scope of the claimed invention without undue experimentation. See MPEP §2164.08(a). Regarding whether the Specification enables any known "photoinitiator," the Examiner acknowledges the Specification discloses a photopolymerized resin, formed of an epoxy resin or a cyanate monomer, **a photoinitiator** See the Specification, page 4, lines 9-12. The Specification discloses photoinduced polymerizable cyanate ester compositions having an organometallic complex photoinitiator. See the Specification, page 19, lines 8-12. Such organometallic complex photoinitiators are aryldiazonium, triphenylsulfonium, diphenyliodonium, diaryliodosyl and triarylsulfoxonium salts. See the Specification, page 5, lines 11-12, page 21, lines 26-32 and Example 4 using Irgacure 261, diphenyliodonium tetrafluoroborate, from Ciba Gigy. The specification discloses photocatalyzed trimerization of aryl isocyanates using metal carbonyl complexes and energy polymerizable compositions comprising ionic salts of organometallic complex cations. See the Specification, page 23, lines 21-25. The Examiner states, with respect to Claim 17, it is the Examiner's understanding that the diazonium and onium salts are employed in epoxy resin precursors, while organometallic complex salts are employed for cyanate ester resin precursors. However, Applicants' Specification discloses exceptions to the Examiner's summary. For example, the Specification discloses photocuring Arocy L10 (a cyanate ester)

from Ciba in Example 4 using an onium salt, Irgacure 261, diphenyliodonium tetrafluoroborate, from Ciba Gigy. See Cationic Photopolymerization of 2-(9-carbazolyl) Ethyl Vinyl Ether, R. Budreckiene, R. Lazauskaite, J.V. Grazulevicius, and N. Kreiveniene, Environmental and Chemical Physics, Vol. 22, No 3-4, p.p. 151-156, 2000, http://www.fi.lt/E&cp/22_3_4/paper_9.htm (herewith enclosed as Appendix 1), disclosing that Irgacure 261 is the onium salt η^5 -2,4-cyclopentadien-1-yl[(1,2,3,4,5,6- η)-(1-methylethyl)benzene]-iron (+)-hexafluorophosphate (-1). Applicants respectfully assert the Examiner's rejection of Claims 13-24 and 27-29 was improper because 1) the scope of photoinitiator in the claims is the same as the scope in the Specification; and 2) one skilled in the art could determine if a specific photoinitiator will cure the composition of the present invention without undue experimentation. MPEP §2164.08 states "when analyzing the enabled scope of a claim, the teachings of the specification must not be ignored because claims are to be given their broadest reasonable interpretation that is consistent with the specification." Here, the Specification teaches photoinitiators generally, including specific photoinitiators such as diazonium and onium salts, metal carbonyl complexes and salts of complex organometallic cations. Prong 1 of the test is satisfied because the scope of the term photoinitiator is taught by the aforementioned examples of photoinitiators in the specification. Prong 2 is satisfied because one skilled in the art could determine whether a particular photoinitiator will cure the composition without undue experimentation.

The Examiner rejected Claims 13-24 and 27-29 under 35 U.S.C. §112, first paragraph, allegedly because the Specification does not reasonably provide enablement of a method wherein the composition comprises a cyanate ester, any known "photoinitiator" and any known

"dispersed filler." Regarding whether the Examiner's rejection was proper, the test is the same two prong test supra under MPEP §2164.08: 1) whether the scope of the term filler in the claims is the same as the scope in the Specification; and 2) whether one skilled in the art could determine if a specific filler will meet the readiness to flow characteristic of the composition of the present invention without undue experimentation. See the Specification, page 25, lines 6-9, stating the necessity that the uncured material flows under the integrated circuit chip housing. The Examiner acknowledges the Specification discloses fillers that are thermally conductive and electrically insulating. See the Specification, page 24, lines 24-28. The MPEP states "an applicant may rely not only on the description and drawing as filed but also on the original claims if their content justifies it" (emphasis added). See the MPEP § 608.01(l) Original Claims.

Here, Applicants first rely *inter alia* on the description that broadly discloses that Applicants' composition comprises a filler without limitation as to particle size. See the Specification, page 19, line 8. Secondly, Applicants rely *inter alia* on the disclosure that discloses specific thermally conductive and electrically insulating fillers without limitation as to particle size. See Applicants' Specification, page 24, lines 24-28. Thirdly, Applicants rely *inter alia* on original claim 1, that claims a cyanate ester composition comprising *inter alia* a filler for controlling thermal expansion of said composition and for assisting in reinforcing said bond; See Applicants' original claim 1, page 33, line 8.

Here, Applicants assert the Examiner's rejection of Claims 13-24 and 27-29 was improper because 1) the scope of term filler in the claims is the same as the scope in the Specification; and 2) one skilled in the art could determine if a specific filler will provide the necessary flow characteristic for the composition of the present invention without undue

experimentation. MPEP § 2164.08 states, "when analyzing the enabled scope of a claim, the teachings of the specification must not be ignored because claims are to be given their broadest reasonable interpretation that is consistent with the specification." Here, the Specification teaches fillers such as Aluminum Oxide, 92% Alumina, 96% Alumina, Aluminum Nitride, Silicon Nitride, Silicon Carbide, Beryllium Oxide, Boron Nitride and Diamond powder either high pressure or Plasma CVD that are thermally insulating and electrically conductive. See the Specification, page 24, lines 24-28. The Specification also teaches use of silica having a particle size 31 microns or less so the uncured composition will have necessary flow characteristics. See the Specification, page 25, lines 4-10. Here, prong 1 of the test is satisfied because the scope of the term filler is taught by the aforementioned examples of filler in the specification. Prong 2 is satisfied because one skilled in the art could determine whether the particular filler in the uncured composition will provide the necessary flow characteristic without undue experimentation.

35 U.S.C. §112, second paragraph

The Examiner rejected Claims 18 and 20 under 35 U.S.C. §112, second paragraph, because there is allegedly no antecedent basis for "dispersed silica." Accordingly, Applicants have amended Claim 18 for clarity and canceled Claim 20.

In light of the foregoing arguments, Applicants respectfully contend that Claims 13-19, 21-24 and 27-29 under 35 U.S.C. §112, first and second paragraphs, are in condition for allowance because Claim 18 has been amended for clarity.

35 U.S.C. 103(a)

The Examiner rejected claims 13-22, 24 and 27-29 under 35 U.S.C. §103(a) as being allegedly unpatentable over Christie *et al.* (5,250,848) in view of Gaku *et al.* (4,554,346). Applicants respectfully contend the Examiner's rejection of Claims 13-22, 24 and 27-29 under 35 U.S.C. §103(a) fails because the Examiner improperly combined Christie *et al.* in view of Gaku *et al.* The Examiner acknowledges that Christie *et al.* disclose a method for forming an encapsulant for a solder interconnect, wherein the encapsulant comprises a cycloaliphatic polycarbonate and/or a curable cyanate ester. See the Office Action, page 5. The Examiner acknowledges Christie *et al.* do not teach employing a photoinitiator or photocuring, so the Examiner combined Christie *et al.* in view of Gaku *et al.*, because Gaku *et al.* teaches employing a photoinitiator or photocuring. See *Id.* However, Applicants note that Gaku *et al.* does not teach *inter alia* Applicants Claim 13: "A method for encapsulating a solder joint between an integrated circuit chip and a substrate, comprising the steps of: forming a composition that includes a photoinitiator, a filler, and a resin precursor, wherein the filler has a particle size of 31 microns or less if the filler is silica, and wherein the resin precursor consists essentially of a cyanate ester monomer, a cyanate ester prepolymer, or a mixture of the monomer and prepolymer;" (emphasis added). Instead, the Examiner acknowledges Gaku *et al.* discloses a curable resin comprising a hydroxy-functional ethylenically unsaturated compound. See the Office Action, page 5, stating Gaku *et al.* disclose . . . a hydroxy-functional ethylenically unsaturated compound Applicants respectfully disagree with the Examiner's statement "It would have been obvious to one skilled in the art to employ a photoinitiator and photocuring in the compositions and method disclosed by Christie *et al.*, as suggested by Gaku *et*

al.“ See *Id.* Applicants respectfully contend one skilled in the art would not be motivated to combine Christie *et al.* with Gaku *et al.* to photocure the curable resin of Christie *et al.* because the curable resin of Gaku *et al.* use a hydroxy-functional ethylenically unsaturated compound instead of the cycloaliphatic polyepoxide and/or a curable cyanate ester of Christie *et al.* In other words, Gaku *et al.* does not teach or suggest photocuring Christie's resin. Also, the Examiner's remarks concerning providing products having excellent heat resistance and electrical properties is irrelevant to the issue of photocuring Christie's resin. Therefore, Applicants' conclude the Examiner's rejection of Claims 13-22, 24 and 27-29 under 35 U.S.C. §103(a) fails because the Examiner improperly combined Christie *et al.* in view of Gaku *et al.*

The Examiner rejected claims 13-16, 18-22 and 27-29 under 35 U.S.C. §103(a) as being allegedly unpatentable over Christie *et al.* (5,250,848) in view of McCormick *et al.* (5,744,557). Applicants respectfully contend the Examiner's rejection of Claims 13-22, 24 and 27-29 under 35 U.S.C. §103(a) fails because the Examiner improperly combined Christie *et al.* in view of McCormick *et al.* The Examiner noted, “McCormick *et al.* teach cyanate ester/free radically polymerizable monomer adhesives for electronic adhesives.” See the Office Action, page 6 and McCormick *et al.*, Column 19, lines 61-67 and Column 20, lines 1-9, stating “The adhesives of the invention may be produced by combining an effective amount (preferably 20 to 80 weight percent,, of the total composition) of a cyanate ester monomer or oligomer, an effective amount (preferably 80 to 20 weight percent,, of the total composition) of an ethylenically unsaturated monomer or prepolymer,” Applicants respectfully contend one skilled in the art would not be motivated to combine Christie *et al.* with McCormick *et al.* to photocure the curable resin of Christie *et al.* because the curable resin of McCormick *et al.* uses a

ethylenically unsaturated monomer or prepolymer instead of the cycloaliphatic polyepoxide and/or a curable cyanate ester of Christie *et al.* In other words, McCormick *et al.* do not teach or suggest photocuring Christie's resin. Therefore, Applicants' conclude the Examiner's rejection of Claims 13-22, 24 and 27-29 under 35 U.S.C. §103(a) fails over Christie *et al.* in view of McCormick *et al.* for the same reason the Examiner's rejection of Claims 13-22, 24 and 27-29 under 35 U.S.C. §103(a) fails over Christie *et al.* in view of Gaku *et al.*

The Examiner rejected claim 23 under 35 U.S.C. §103(a) as being allegedly unpatentable over Christie *et al.* (5,250,848) in view of Gaku *et al.* or McCormick *et al.*, as applied to Claim 13 above, and further in view of Papathomas *et al.* (5,194,930). Applicants respectfully contend the Examiner's rejection of Claim 23 under 35 U.S.C. §103(a) fails because Christie *et al.* (5,250,848) in view of Gaku *et al.* or McCormick *et al.*, as applied to claim 13 above, and further in view of Papathomas *et al.* (5,194,930) is an improper combination for the same reason *supra* that Christie *et al.* (5,250,848) in view of Gaku *et al.* or McCormick *et al.* are an improper combination.

In light of the foregoing discussion, Applicants respectfully submit that Claims 13-16, 18-19, and 21-29 and Claims 14-16, 18-19, and 21-29, that depend from Claim 13, are in condition for allowance under 35 U.S.C. 103(a), because Christie *et al.* in view of Gaku *et al.* or Christie *et al.* in view of McCormick *et al.* were improperly combined.

CONCLUSION

In summary, based on the preceding arguments, Applicants respectfully submit that all independent claims and dependent claims meet the acceptance criteria for allowance and therefore request favorable action. If the Examiner believes that anything further would be helpful to place the application in better condition for allowance, Applicants invite the Examiner to contact Applicants' representative at the telephone number listed below.

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APPENDIX 1

1. Cationic Photopolymerization of 2-(9-carbazolyl) Ethyl Vinyl Ether, R. Budreckienė, R. Lazauskaitė, J.V. Gražulevičius, and N. Kreivenienė, *Environmental and Chemical Physics*, Vol. 22, No 3-4, p.p. 151-156, 2000, http://www.fi.lt/E&cp/22_3_4/paper_9.htm.

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**Cationic photopolymerization of 2-(9-carbazolyl)
ethyl vinyl ether**

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Abstract - The photopolymerization of 2-(9-carbazolyl) ethyl vinyl ether (CEVE) initiated with diphenyliodonium tetrafluoroborate (DPIT), di(tert-butylphenyl) iodonium tetrafluoroborate (BPIT), cyclopropyldiphenyl sulfonium tetrafluoroborate (CPST) and $(\eta^5-2,4\text{-cyclopentadien-1-yl})[(1,2,3,4,5,6\text{-}\eta)\text{-(1-methyl ethyl)benzene}]$ -iron (+)-hexafluorophosphate (-1) (Irgacure 261) has been investigated. It has been established that the efficiency of the iodonium salts is much higher in the cationic photopolymerization of CEVE than that of the sulfonium salt and iron-arene complex. The oligomers with a highest degree of polymerization of 43 are obtained in the CEVE photopolymerization initiated with BPIT. The influence of temperature on the rate of the CEVE photopolymerization, the molecular weight and the conversion limit is discussed.

Key words: Photopolymerization, vinyl ether, carbazole, iodonium salt, sulfonium salt, iron-arene complex.